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(71) Applicants
Unilever Limited
Unilever House,
Blackfriars,
London EC4, England.
(72) Inventors
Iain Cunningham Mutter
Dea
Devamanohari Pillai
(74) Agent
Mr. T.C. Stancliffe

(54) Improvements in ice confections and their preparation

(57) Hardened stabilised ice cream confections comprise aerated compositions of ice crystals, edible fat particles and aqueous syrupy phase, shear-frozen under aeration, extruded at nozzle temperatures of about -8°C to -13°C, hardened at -20°C or colder, and contain sugars, sugar alcohols or other low molecular weight materials in amounts molarly equivalent to more than 32% by weight disaccharide, with overruns of 140% or more, and have their hardness at -18°C expressed by log H = 0.85 or less: the confections though storable in the deep-freeze, have eating qualities analogous to those of soft-serve ice cream when eaten direct from the deep freeze.

SPECIFICATION

Improvements in ice confections and processes for their preparation

This invention relates to ice cream confections and methods of making them, and concerns improved confection compositions and their preparation.

A large variety of ice confection products is known with a correspondingly wide range of formulations. Several are described in, for example, GB Specifications Nos.1,456,207; 696,287; and US Patent No. 3,993,793. One popular variant of ice cream is so-called "soft-serve" ice cream. Its preparation is described in, for example, W.S.Arbuckle, "Ice Cream", AVI Publishing Co., 1972, 2nd edition, pp 278-285, 398.

Soft-serve ice cream is prepared and served at −5° to −8°C, and in practice requires preparation and machinery at the place where it is sold and consumed. This need for local preparation is associated with a number of difficulties. For example, it is often hard to ensure adequate microbiological safety standards for the machinery and raw materials. The preparation requires much labour and time. The product has poor keeping qualities: it becomes very hard on deep-frozen storage but at eating temperatures melts down very quickly.

By this invention we provide a stabilised ice cream confection which has been hardened, i.e. equilibrated at deep-freeze temperature, e.g. −20°C or colder (although hardening can also be carried out at ≤ −25°C), and which, however, at −18°C possesses a hardness which corresponds to a log H measurement (as hereinafter described) of less than 0.85, preferably 0.75.

We find surprisingly that an ice cream confection according to the invention has organoleptic properties strikingly similar to "soft-serve" ice cream when it is eaten directly from the deep-freeze, i.e. storage at about -18°C. Its "mouthfeel" and texture characteristics when used in this way prove to be acceptable to consumers in a similar way to the acceptability of soft-serve ice cream.The product has the advantage that it can be prepared at a place remote from the point of sale or consumption (thus, also under clean and supervised factory conditions), and it can be stored at convenience, and eaten direct from storage, with retention of its desirable organoleptic properties. Therefore, it represents a new category of frozen confection.

"Ice cream confection", in this context, means a confection composition consisting of an aerated mixture of ice crystals, fat particles and a syrupy aqueous phase, which has been agitated during freezing (i.e. "shear frozen"). Its fat content is below 15% by weight, normally in the range 6-14%, e.g. about 8% by weight.

A variety of parameters of the formulation can be controlled to ensure the hardness characteristic, as mentioned above, which should be (log H) of 0.85 or less, preferably 0.6-0.75 or even less, e.g. 0.5 but greater than 0.1.

The overrun of an ice cream confection according to the invention should preferably be within the range 140-200%, preferably above 145-150%, e.g. 160%-175%. Although overrun > 200% can be used, this necessitates extra stabilisation and, hence is not preferred.

We have surprisingly found that in certain embodiments of the invention it helps ready achievement of the desired low hardness degrees to extrude the shear-frozen, aerated ice cream confection at about -10°C or below, eg. at colder than −8°C down to about −13°C, in practice at as low a temperaure as can be managed. Otherwise, the physical ice cream processing can be carried out in accordance with the known industrial good practice, e.g. as to homogenisation, pasteurisation, freezing, aeration and extrusion. Conventional ice cream stabilisers such as locust bean gum and carageenan can be used. Furthermore, the ice cream confections according to this invention preferably contain quantities of sugars and/or sugar alcohols or other lowmolecular weight materials, e.g.m.w.≤600, in quantities molarly equivalent to more than 32% by weight of disaccharide, e.g. above 34% to more than 36%, and for exmple about 38-43%.

The ice content of the ice cream confections at -18°C is then preferably less than 46% by weight, often less than 44%, e.g. in the range 41-44%, for example 42%.

Accordingly, the ice cream confections can be conveniently formulated using greater than normal quantities of freezing point depressants such as sugars or sugar alcohols, e.g. sucrose, glucose, fructose, (e.g. as invert sugar), sorbitol and glycerol. Glycerol is a particularly convenient ingredient at, for example, 1-5% by weight of the formulations, though it must be stressed that good results are achieved by the use of the other ingredients mentioned.

The milk or non-milk fat used in these compositions, the sources of non-fat milk solids, and other optional additives and flavourants (e.g.fruit or other dessert materials), are capable of conventional variation, form no part of the novelty of the present invention, and need no further description.

It can be seen that many of the stabilised ice cream compositions according to the present invention are aerated compositions of ice crystals, edible fat particles and aqueous syrupy phase, which have been shear-frozen under aeration, extruded at nozzle temperatures in the range -8°C to -13°C and hardened (equilibrated) at -20°C or colder, and contain sugars and/or sugar alcohols and/or other low molecular weight materials of m.w.≤600 in amounts molarly equivalent to more than 32% by weight of disaccharide ($C_{12}H_{22}O_{11}$), with overruns of 140% or more, and at −18°C exhibit hardnesses of log H = 0.85 or less, (when the log H measurement is defined and performed as described below).

Accordingly the invention also provides a process for preparing an ice cream confection, which comprises shear-freezing an aqueous confection mix containing dispersed edible fat and sugars and/or sugar alcohols and/or other low molecular weight materials of m.w. ≤600 in amounts molarly equivalent to a concentration

of disaccharide greater than 32% by weight, aerating the mix to an overrun of at least 140%, and hardening the extruded ice cream at −20°C or colder, to produce a hardened ice cream confection having a hardness corresponding to log H - 0.85 or less.

Log H, as defined in this specification, is the logarithm (base 10) of a hardness measure obtainable by the following or an equivalent test method.

Apparatus

The Instron

The log H measurements were carried out using the Instron Universal Tester model 1122(TradeMark). The sensing table on the Instron was enclosed by a thermostatically controlled temperature cabinet, which operated between a temperature range of +200°C and -70°C. The colder temperatures were obtained by cooling the cabinet with liquid Nitrogen, contained in a self pressurising 50 litre Dewar, which was connected to the back of the cabinet. The ice cream samples could therefore be tested in a temperature controlled environment at any desired temperature. The cabinet was modified to enable easy removal of the load cell. It was also fitted with a glass window panel so that observation of the sample deformation etc. during the measurements was possible.

Measurement

The hardened ice cream samples were tempered in a −18°C cold room for at least 24 hours before any measurements were carried out. The samples were 40 mm thick. Samples were duplicated. Measurements were only carried out when the sample temperature was within±0.2°C of -18°C, as measured with a standard Comark (Trade Mark) temperature probe.

The sample of ice cream was placed on a platform, which was secured to the sensing table of the Instron with Vaseline, to prevent movement during measurement. The platform contained a "hole" (diameter 31.5 mm) through which the core of the ice cream was forced out as a plunger (diameter 29.46 mm) was pushed through the ice cream at a rate of 20 mm/min. As the plunger moved through the ice cream a shear force (in Newtons) was recorded on the Instron trace. H is the maximum force recorded, and is conveniently quoted as a logarithm, log H.

Particular and non-limitative embodiments of the invention will be illustrated further by the following examples.

EXAMPLE 1

An ice cream confection was formulated as follows:

	%(weight)
Spray-dried milk powder	9.42
Whey powder	1.11
Sucrose	14.12
Glycerol	5
Maltodextrin(40 DE)	2.82
Butter	7.45
Mono/Di-glycerides of palm oil	0.45
Locust bean gum	0.2
Carragel MS 20 (Trade Mark, from Bulmers) (Carrageenan)	0.03
Dairy colour and flavour	0.035
Water	to 100

The processing followed conventional good practice except for the following processing conditions:

Overrum = 170%;

Extrusion temperature = −12°C.

After the extruded product had been hardened at −20°C overnight, measurement as described above showed that its log H at −18°C was 0.70±0.02.

The product of the Example had good stability and was a firm hardened ice cream after deep-freeze storage, but its softness (log H =0.70) was such that it had the organoleptic qualities of soft-serve ice cream directly on consumption from the deep-freeze, with good mouthfeel, flavour and texture characteristics.

EXAMPLES 2-4

Further ice cream confections were prepared as in Example 1 but formulated as follows:

Example No.:	2	3	4
Spray dried skim milk powder	9.42%	9.42%	11.84%
Whey powder	1.1 %	1.1 %	–
Sucrose	14.12%	14.12%	12 %
Glycerol	3 %	1 %	1 %
Dextrose monohydrate	3 %	6 %	7 %
Maltodextrin (40 DE)	2.82%	2.82%	–
Coconut oil	8 %	8 %	8 %
Mono/diglycerides of palm oil (Admul MGP, Food Industries Ltd., Bromborough, England)	0.45%	0.45%	0.45%
Locust bean gum (LBG)	0.2 %	0.2 %	0.2 %
Carrageenan (Carragel MS 20) (Trade Mark)	0.03%	0.03%	–
Dairy colour and flavour	0.03%	0.03%	0.03%
Water	to 100	% in each case	

The textural and organoleptic results in each case were acceptably similar to those obtained in Example 1: overruns used were 160%-170%, extrusion temperatures -10° to -12°C, and hardness levels obtained correspond to log H in the range 0.7-0.8.

EXAMPLES 5 and 6

Further ice cream confections were prepared as in the preceding Examples 2-4 but formulated as follows:

Example No.:	*5*	*6*
Spray dried skim milk powder	12 %	9.42%
Whey powder	1.5%	1.11%
Sucrose	15 %	14.12%
Fructose	2 %	-
Dextrose monohydrate	3 %	-
Corn syrup (40 DE)	4.5%	2.82%
Glycerol	-	2 %
Invert sugar (75% solids)	-	5.36%
Coconut oil	8 %	8 %
Mono/Diglycerides of palm oil	0.45%	0.45%
locust bean gum (LBG)	0.2 %	0.2 %
Carrageenan	0.03%	0.03%
Dairy colour and flavour	0.03%	0.03%
Water	100% in each case	

Similar textural and organoleptic results were obtained to those of Examples 2-4.

CLAIMS

1. A stabilised ice cream confection which has been hardened (as hereinbefore defined) and which has a hardness at -18°C which corresponds to a log H measurement (as hereinbefore defined) of at most0.85.
2. An ice cream confection according to claim 1 in which the log H measurement is at most 0.75.
3. An ice cream confection according to claim 1 in which the log H measurement if in the range 0.6-0.75.
4. An ice cream confection according to any preceding claim in which the overrun is in the range 140-200%
5. An ice cream confection according to claim 4 in which the overrun is at least 145%.
6. An ice cream confection according to claim 4 in which the overrun is at least 150%.
7. An ice cream confection according to claim 4 in which the overrun is in the range 160-175%.
8. An ice cream confection according to any preceding claim which has been extruded at a temperature colder than -8°C.

9. An ice cream confection according to claim 8, which has been extruded at a temperature in the range below -8° to -13°C.

10. An ice cream confection according to claim 8 which has been extruded at a temperature in the range -10°C to -12°C.

11. An ice cream confection according to any preceding claim, containing sugar and/or sugar alcohol and/or other low-molecular weight edible compounds of m.w. ≤600, in an amount more than the molar equivalent of 32% by weight of disaccharide $C_{12}H_{22}O_{11}$.

12. An ice cream confection according to claim 11, in which said amount is the molar equivalent of at least 34% disaccharide.

13 An ice cream confection according to claim 11 in which said amount is the molar equivalent of at least 36% disaccharide.

14. An ice cream confection according to claim 11 in which said amount is the molar equivalent of 38%-43% disaccharide.

15. An ice cream confection according to claim 11, containing 1-5% glycerol by weight.

16. An ice cream confection according to claim 11, containing glycerol, sorbitol, fructose or invert sugar.

17. An ice cream confection according to any preceding claim, which has an ice content of less than 46% by weight at -18°C.

18. An ice cream confection according to claim 17, which has an ice content of less than 44% by weight at -18°C.

19. An ice cream confection according to claim 17, which has an ice content in the range 41%-44% by weight at -18°C.

20. An ice cream confection according to claim 17, which has an ice content of about 42% at -18°C.

21. A process of producing an ice cream confection which comprises hardening (as hereinbefore defined) an ice cream confection to a hardenss which at −18°C corresponds to a log H measurement (as hereinbefore defined) of at most 0.85.

22. A process according to claim 21, in which the ice cream is hardened to a hardness as defined in claim 2 or 3.

23. A process according to claim 21, wherein the iece cream confection has the characteristics defined in any one of claims 4 to 18.

24. An ice cream confection substantially as hereinbefore described with respect to any one of the Examples.

25. A process according to claim 21 substantially as hereinbefore described with respect to any one of the Examples.

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